

Review

Health impact of climate change due to combustion of fossil fuel

M. R. Usikalu

Department of Physics, Covenant University, Ota, Ogun State, Nigeria. E-mail: jisola2009@yahoo.com.

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The analysis of temperature data obtained from the National Oceanic and Atmospheric Administration (NOAA) database showed that each of the last 13 years was one of the warmest years for the last several thousand years in the temperature record. In this study, it was observed that the changes in the weather parameters such as temperature, humidity, wind etc., due to increase in greenhouse gases, adversely affect human health and environment. Consequently, posing challenges to the health of humans and environment. The affected environments are extreme events, storm, crop failure, flood, etc., which manifested in diseases such as malnutrition, diarrhea, malaria, respiratory diseases, heart attacks etc.

Key words: Climate change, health challenges, greenhouse gas, renewable energy.

INTRODUCTION

Climate change is a key public health challenge (IPCC, 2007). Throughout the world, the occurrence of some diseases and other threats to human health has been associated to changes in local climate. Extreme temperatures can lead directly to loss of life, while climate-related disturbances in ecological systems, such as changes in the range of infective parasites, can indirectly impact the incidence of serious infectious diseases. In addition, warm temperatures can increase air and water pollution, which in turn harm human health.

There are many factors that strongly contest with the health of humans which include: social, political, economic, environmental and technological factors, urbanization, affluence, scientific developments, individual behavior and individual vulnerability (e.g., genetic makeup, nutritional status, emotional well-being, age, gender and economic status). The extent and nature of climate change impacts on human health vary by region, by relative vulnerability of population groups, by the extent and duration of exposure to climate change itself and by society's ability to adapt to or cope with the change.

Human beings are exposed to climate change through changing weather patterns. Through direct means, by intense and frequent extreme heat events and indirectly through changes in water, air, food quality and quantity, ecosystems, agriculture, and economy (WHO, 2003).

WHO estimates about 150,000 deaths occur in low-income countries each year due to effects on climate change. This results in crop failure and malnutrition, diarrhea disease, malaria and flooding. Among of the excess deaths recorded; about 85% are young children. At this early stage the effects are small but are projected to progressively increase in all countries and regions.

This paper highlights various health challenges, associated with climate change and the need to reduce the greenhouse gas emission by embracing renewable energy sources because as carbon reduces health improves.

CAUSES OF CLIMATE CHANGE

The word climate describes the average day-to-day weather that a specific region experiences, including location's seasonal extremes and variations. Climate change is a longer-term shift in the climate of a specific location, region, or the entire planet. The features associated with average weather, such as temperature, wind patterns and precipitation, measure this change. A change in the variability of climate is also considered climate change, even if average weather conditions remain unchanged. The major cause of change in our climate is the increased levels of greenhouse gases caused by human

activities.

The natural greenhouse effect

Energy from the sun drives the earth's climate. As the sun's energy reaches the earth's surface, some of it is reflected back and some of it is absorbed by the earth's surface. The absorbed energy warms the earth. This heat is then re-radiated back towards space as terrestrial radiation. Certain gases such as CH₄, N₂O in the earth's atmosphere act as "greenhouse gases" absorbing the radiated infrared energy and thereby trapping some of the heat in the atmosphere. The greenhouse gases radiate this energy in all directions, including back to the Earth again. This energy is used in a number of processes, including heating the ground surface, melting ice and snow, evaporating water, and plant photosynthesis. Most importantly, this energy remains trapped within the climate system, warming the Earth's surface to an average of 14 °C. This phenomenon called the natural greenhouse effect keeps the Earth in a temperature range that allows life to thrive.

Greenhouse effect by human activities

Human activities can disrupt the balance of the global climate system. Any little changes in atmospheric greenhouse gas concentrations will affect the amount of energy stored in the atmosphere. For example, when the amount of carbon dioxide (CO₂), a major greenhouse gas is increased, more heat is trapped in the atmosphere. This enhanced greenhouse effect causes the earth's surface temperature to rise. Since the beginning of the industrial revolution (about 1750 AD), the concentration of all the major greenhouse gases have increased in the atmosphere, thereby helping to bring about the changes in climate that the world is currently experiencing. Many gases in the atmosphere exhibit greenhouse properties. These include those occurring naturally in the atmosphere, such as CO₂, CH₄, N₂O and H₂O vapour, as well as gases produced from human activities (Howard, 2008). Humans are adding more and more greenhouse gases to the atmosphere, mainly through the burning or "combustion" of fossil fuels (that is, petroleum, natural gas and coal) to transport people and goods, heat and cool buildings, generate electricity and operate industries. Also agricultural activities and manufacturing processes such as changes in land cover and land use for agriculture, urbanization and road construction can affect the concentrations of greenhouse gases in the atmosphere. Land use-age often involves the clearing of forests and vegetation. When these large swaths of vegetation are cleared, the area has considerably less capacity to absorb and store CO₂ through photosynthesis (the process by which green plants use energy from the sun to convert CO₂ into fuel for growth). In addition, if

forests are removed by burning, the CO₂ stored in the tree wood is returned to the atmosphere. There are also natural activities that add greenhouse gases to the atmosphere (NRC, 2001). The ability of a greenhouse gas to warm the earth depends on its capacity to absorb heat (known as the "global warming potential" or GWP), as well as on its atmospheric lifetime when released into the atmosphere.

HEALTH EFFECTS DUE CLIMATE CHANGE

Climate change poses substantial risks to human health. Millions of people could be affected and it is anticipated that most of the impacts would be adverse. Increases in mortality from heat waves compounded by more severe urban air pollution are predicted with high confidence. Increases in infectious diseases, and other impacts of climate change, such as sea-level rise and increases in drought in some places and more intense flooding, would also adversely affect public health by increasing hunger in some areas, by damaging infrastructure and displacing populations. Some of the health effects of climate change are presented below:

Direct temperature effect

Climate change may directly affect human health through increases in average temperature. Such increases in temperature may lead to more extreme heat waves during the summer while producing less extreme cold spells during the winter. Rising average temperatures are predicted to increase the incidence of heat waves and hot extremes (IPCC, 2007). This can cause heat related diseases, such as respiratory and cardiovascular illnesses and increased occupational health risks. It was deduced from the temperature data obtained from the National Oceanic and Atmospheric Administration (NOAA) database that each of the last 13 years was one of the warmest years for the last several thousand years in the temperature record. Table 1 presents the 13 warmest years on record and Figure 1 is the graphical presentation of those years for clearer comparison.

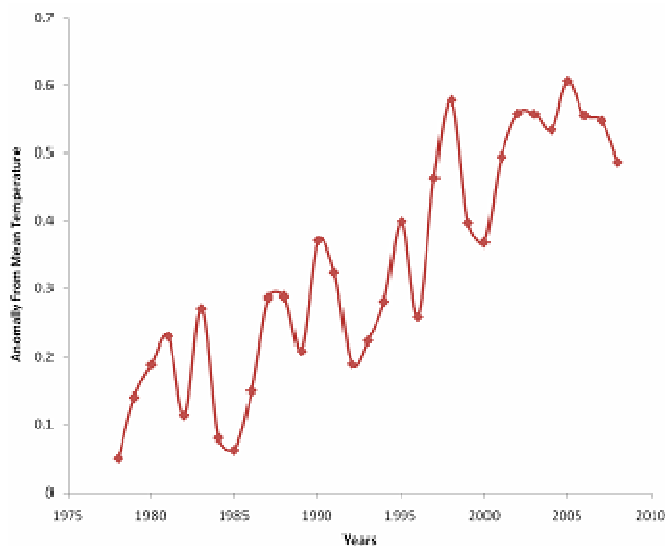
Extreme events

Extreme weather events can be destructive to human health and well-being. The U.S. Climate Change Science Program is investigating the extent to which climate change may affect the frequency and severity of these events, such as hurricanes and extreme heat and floods. An increase in the frequency of extreme events can result in injuries and illnesses, damaged public health infrastructure, social and mental health stress due to disasters, occupational health hazards and population displacement.

Table 1. 13 Warmest years on the global temperature record.

Years	Anomaly from mean temperature
1996	0.2585
1997	0.4631
1998	0.5774
1999	0.3972
2000	0.3673
2001	0.4953
2002	0.5591
2003	0.5583
2004	0.5348
2005	0.6062
2006	0.5564
2007	0.548
2008	0.4871

National oceanic and atmospheric administration (NOAA) temperature database.

**Figure 1.** Warmest years in the last several thousand years.

Vector-borne diseases

Climate change may increase the risk of some infectious diseases; particularly those diseases that appear in warm areas and are spread by mosquitoes and other insects. These "vector-borne" diseases include malaria, dengue fever, yellow fever, etc. Also, algal blooms could occur more frequently as temperatures warm particularly in areas with polluted waters in which case diseases (such as cholera) that tend to accompany algal blooms could become more frequent. Malaria will be re-established in UK this health impact is localized with more cases among

travelers returning to UK also is the increased incidence of Tick-borne lyme disease in Canada (EC, 2002).

Higher temperatures in combination with favorable rainfall patterns could prolong disease transmission seasons in some locations where certain diseases already exist (EPA, 1989). In other locations, climate change will decrease disease transmission via reductions in rainfall or temperatures that are too high for transmission. For example, temperature and humidity levels must be sufficient for certain disease-carrying vectors, such as ticks that carry Lyme disease, to thrive. And climate change could push temperature and humidity levels either towards or away from optimum conditions for the survival rate of ticks (WHO, 2003).

The IPCC has noted that the global population at risk from vector-borne malaria will increase by between 220 million and 400 million in the next century. While most of the increase is predicted to occur in Africa, some increased risk is projected in Britain, Australia, India and Portugal (IPCC, 2007).

Air pollution related health effects

Climate change is expected to contribute to some air quality problems (IPCC, 2007). Respiratory disorders may be exacerbated by warming-induced increases in the frequency of smog (ground-level ozone) events and particulate air pollution.

Ground-level ozone can damage lung tissue, and is especially harmful for those with asthma and other chronic lung diseases. Sunlight and high temperatures, combined with other pollutants such as nitrogen oxides and volatile organic compounds can cause ground-level ozone to increase. Climate change may increase the concentration of ground-level ozone, but the magnitude of the effect is uncertain. For other pollutants, the effects of climate change and/or weather are less well studied and results vary by region (IPCC, 2007).

Another pollutant of concern is particulate matter (PM). Particulate matter is a complex mixture of extremely small particles and liquid droplets. When breathed in, these particles can reach the deepest regions of the lungs. Exposure to particle pollution is linked to a variety of significant health problems. Particle pollution also is the main cause of visibility impairment (haze) in the nation's cities and national parks. Climate change may indirectly affect the concentration of PM pollution in the air by affecting natural or "biogenic" sources of PM such as wildfires and dust from dry soils. It can also cause asthma and other respiratory diseases, heart attacks, strokes and other cardiovascular diseases, cancer, etc. Due to visibility impairment bus crashes into overpass at St. Hyacinthe Quebec City claimed 11 lives, Hercules aircraft crash near Alert NU on 30th October 1991 which claimed 18 lives and also in Tokyo Japan Air DC8 crash on Sewall which claimed 64 lives (EC, 2002).

Decline in agriculture yields

Regional climate change impacts on agricultural yields and production are likely to grow over time with the most negative effects expected in developing countries. This is expected to increase the number of undernourished people globally and consequently lead to complications in child development (IPCC, 2007). An increase in average temperature can: lengthen the growing season in regions with a relatively cool spring and fall; adversely affect crops in regions where summer heat already limits production; increase soil evaporation rates, and increase the chances of severe droughts. This will in turn affects crops that are currently near climate thresholds e.g. wine grapes in California are likely to suffer decrease in yields and quality also North America will experience decrease in agriculture yield due to climate change (Kristie and Ess, 2008).

SOCIO-ECONOMIC IMPACTS

Climate change may also contribute to social disruption, economic decline, displacement of populations (Schwartz and Randall, 2003), loss of income and productivity, diminished quality of life, increased costs of health care and health effects of mitigation technologies. These issues are likely to be more severe in developing countries, and may worsen human health and well being in affected regions (IPCC, 2007).

Ultraviolet (UV) exposure

Level of UV radiation reaching the earth's surface may increase due to sunnier summers, a decline in cloud cover and ozone depletion (which reduces the capacity of the ozone layer to absorb UV). This can cause skin damage and skin cancer, cataracts and disturbed immune function. However, UV exposure is also related to people's behaviour (DoH, 2002). Overall, the Department of Health (DoH) assessment predicted an extra 5,000 cases of skin cancer and 2,000 of cataract per year by 2050 (DoH, 2004).

Water and food-borne disease

Climate change might increase levels of cryptosporidium and other microorganisms which were related to precipitation levels in the river this will in turn affect water and food. Also possible contamination of storm water outflows could carry disease into basements and nearby rivers, affecting the health of residents and river users, diarrheas and illnesses caused by chemical and biological contaminants.

Here are some measures that could be taken in order

to limit the health risk of the climate change.

- Measures should be taken to reduce greenhouse gases in all sectors (transport, housing, energy, agriculture) that generate positive health outcomes.
- Adapting to the health impacts. Lowering the greenhouse gas emissions will not immediately eliminate the risks that climate change can pose. Even if rapid emissions reductions are achieved, the impacts of climate change will continue to be felt for many decades to come. Adaptive actions can be undertaken to help minimize the risks.
- Strengthening health systems to cope with the health threat posed by climate change, including emergencies related to extreme weather events and sea-level rise. These include smog alerts, boil water advisories, infectious diseases monitoring and surveillance.
- Emergency preparedness and planning.
- Promoting and supporting the generation of scientific evidence.

Conclusion

According to the temperature data obtained in the National Oceanic and Atmospheric Administration (NOAA) database, it was deduced that each of the last 13 years was one of the warmest years for the last several thousand years in the temperature record. This clearly shows that the climate is changing fast. Health hazards from climate change are diverse, global and difficult to reverse over human time scales. They range from increased risks of extreme weather events to effects on infectious disease dynamics and sea level rise leading to salinization of land and water sources. It is also observed that the impacts of climate change is unequally felt, the people at greatest risk of climate related health disorder and premature deaths are the poor, the geographical vulnerable, the very young, women and elderly. Feasible improvements in environmental conditions could reduce the global disease burden by more than 25%. A large part of current burden is linked to fossil fuel consumption and transport systems. Changing these systems, by embracing alternative energy sources (renewable energy) to reduce climate change would have the added benefit of addressing some major public health issues.

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